



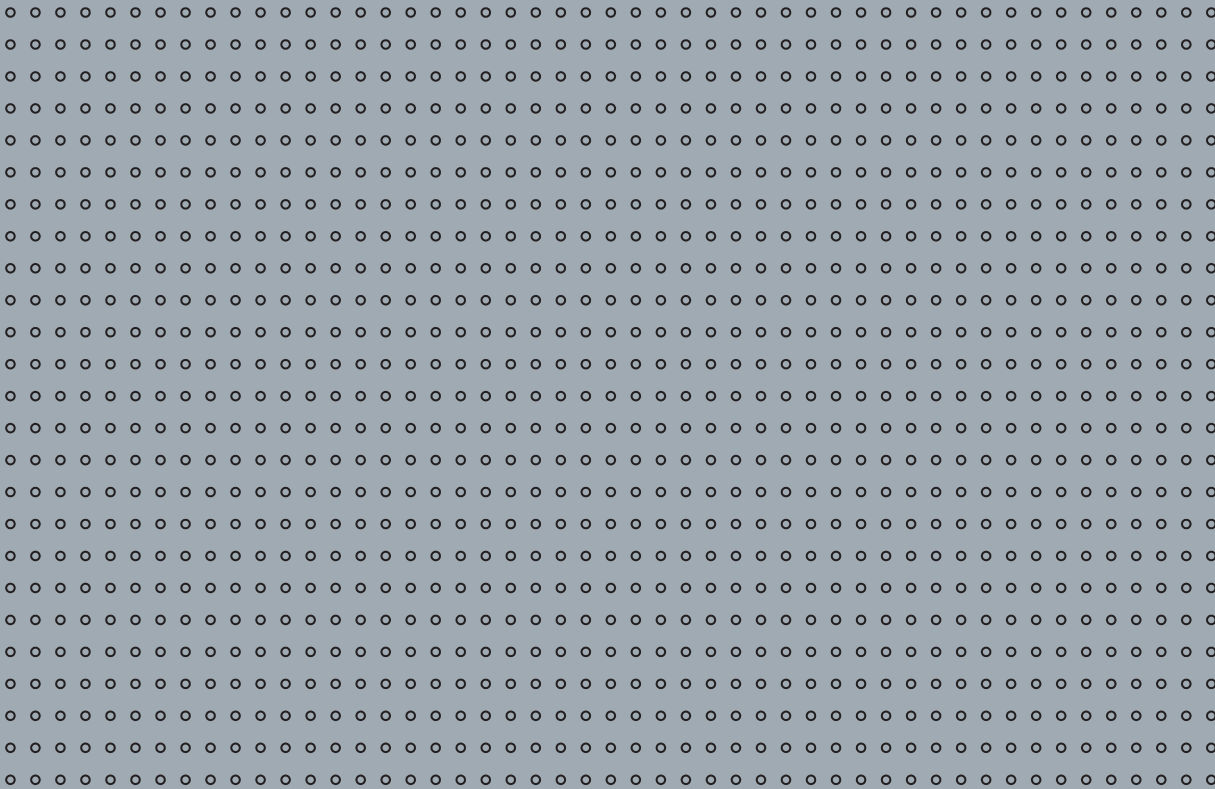
Master the Elements

Operator manual

Simrad AP50
Autopilot

English

Sw.1.3



About this document

Rev. A	First issue.
Rev. B	Updated according to software revision V1R2. Minor corrections in text. RF14XU added.
Rev. C	Updated according to software revision AP: 1.2.02 and J50: 1.2.02. CI300X substituted by GI51. S100 substituted by JS10. Technical Specifications for RI9 and Panorama Mk2 indicators included.
Rev. D	The AP50 Instruction Manual was splitted into one Operator Manual and one Installation Manual. Manuals updated according to software version 1.3. S9 Steering Lever, QS50 Quick Stick and JD5X Distribution Unit included in the System Description section. TI50 updated to TI51.
Rev. E	Minor corrections in text.

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Operator Manual

This manual is a reference guide for operating the Simrad AP50 Autopilot. The manual applies for both a Standard System and a Plus System.

Great care has been taken to simplify the set-up and operation of the AP50; however, an autopilot is a complex electronic system. It is affected by sea conditions, speed of the vessel, and vessel hull shape and size.

Please take the time to read this manual to gain a thorough understanding of the Simrad AP50 autopilot's system components and operation. For configuration and set-up, please refer to the AP50 Installation Manual.

Caution !

An autopilot is a very useful navigational aid, but it DOES NOT under any circumstance replace a human navigator.

Do not use automatic steering when:

- *In heavy traffic areas or in narrow waters*
- *In poor visibility or extreme sea conditions*
- *When in areas where use of autopilot is prohibited by law*

When using an autopilot:

- *Do not leave the helm unattended*
- *Do not place any magnetic material or equipment near any magnetic or fluxgate compass used in the autopilot system*
- *Verify the course and position of the vessel at regular intervals*
- *Always switch to Standby mode and reduce speed in sufficient time to avoid hazardous situations*

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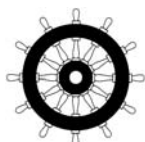
1 SYSTEM DESCRIPTION

1.1 Introduction

Congratulations on the purchase of your new Simrad AP50 autopilot system and thank you for selecting what we feel is one of the most advanced autopilot systems available on the market today.

Today, Simrad manufactures a complete range of autopilots for all types of vessels, from leisure boats to advanced steering systems for merchant marine vessels. Our factory for these products is located in Egersund on the southwest coast of Norway. The company's involvement in autopilots began in 1953 with equipment for the North Sea fishing fleet under the brand name Robertson. Professional mariners around the world acknowledge that the Robertson and Simrad brand names are synonymous with the absolute best in autopilot technology.

The brain in the AP50 autopilot system is an "intelligent" junction unit or distribution unit that communicates with all other system modules on a Robnet network. The Robnet has been developed to establish a reliable digital communication and power distribution network between the units in the system. The Robnet simplifies installation and enables the AP50 system to be easily expanded at any time. Any unit that is connected to the autopilot system via Robnet is called a Robnet Unit.



The AP50 system is produced and tested in accordance with the European Marine Equipment Directive 96/98. This means that the AP50 complies with the highest level of tests for non-military marine electronic navigation equipment existing today.

The Marine Equipment Directive 96/98/EC (MED), as amended by 98/95/EC for ships flying EU or EFTA flags, applies to all new ships, to existing ships not previously carrying such equipment, and to ships having their equipment replaced.

This means that all system components covered by annex A1 must be type-approved accordingly and must carry the Wheelmark, which is a symbol of conformity with the Marine Equipment Directive.

While the AP50 may be installed on vessels not needing to comply with the Marine Equipment Directive, those requiring compliance must have one AP50 Control Unit set-up as a "master unit" in order for the installation to be approved (see also the AP50 Installation Manual, Master Operation).

Simrad has no responsibility for the incorrect installation or use of the AP50 autopilot, so it is essential for the person in charge of the installation to be familiar with the relevant requirements as well as with the contents of this manual, which covers correct installation and use.

The purpose of the Marine Equipment Directive is to enhance safety at sea and to prevent marine pollution through the uniform application of the relevant international instruments relating to equipment listed in Annex A1.

As there are many interfacing requirements in the standards/codes, integrated systems and integrated certification lead to more efficient and effective management of safety, environmental, issues and quality.

The Marine Equipment Directive also constitutes a part of the International Safety Management (ISM) Code. The ISM Code was included as a new chapter (IX) of SOLAS in 1994, and is mandatory for: passenger ships not later than 1st of July, 1998; oil tankers; chemical tankers; gas carriers; bulk carriers and cargo high speed craft of 500 gross tonnage and upwards not later than 1st of July, 1998; and other cargo ships and mobile offshore drilling units of 500 gross tonnage and upwards not later than 1st of July, 2002.

It is required that both the shipping company and ships shall be certified by the Administration (the government of the state whose flag the ship is entitled to fly), by an organization recognized by the Administration or by the government of the country acting on behalf of the Administration.

1.2 How to Use This Manual

This manual is intended as a reference guide for operating the Simrad AP50 autopilot and the optional auxiliary equipment.

Installation and configuration instructions are found in the separate AP50 installation manuals P/N 20222469 (Standard System) and P/N 20222410 (Plus System).

At the end of this manual, you will find an index and a glossary, which will help you when studying the manual.

1.3 System Components

A basic AP50 system may consist of the following units (refer to Figure 1-1):

- AP50 Control Unit with accessories
- Heading Sensor
- Rudder Feedback Unit with transmission link
- Junction Unit
- Drive Unit

The basic system can be expanded with remote control unit, hand held remote and steering lever.

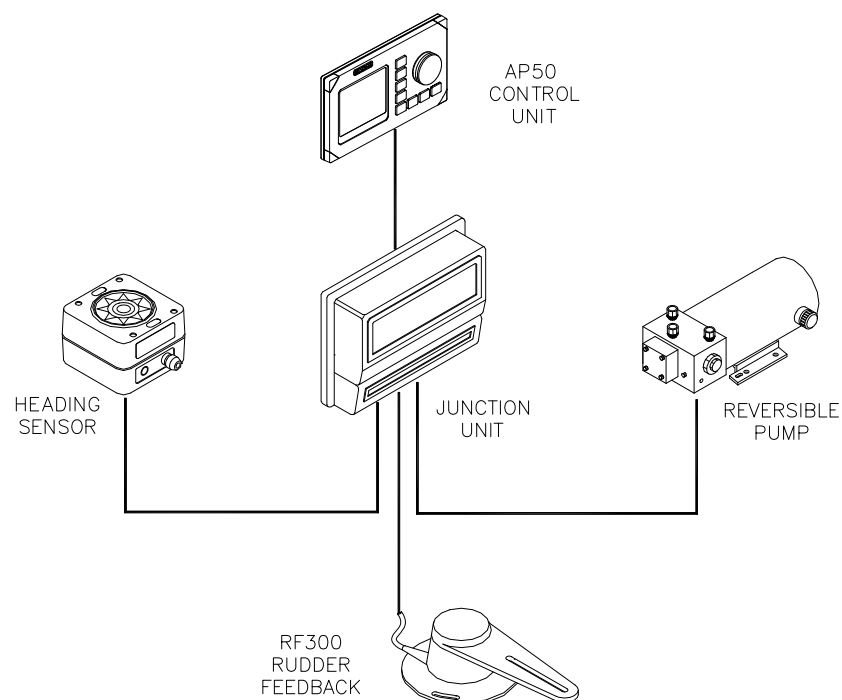


Figure 1-1 AP50 Basic system

1.4 AP50 Control Unit

This compact autopilot control for panel, bulkhead- or bracket-mounting has a rotary course knob and a large LCD for readout of autopilot data. It also has two Robnet connectors for system interconnection and expansion.

1.5 Junction Units

The junction unit in the AP50 autopilot system contains the steering computer, interface circuits to all system components, and drive circuits for the drive unit motor and clutch. Two models, J50 and J50-40, are available.

1.6 JD5X Distribution Unit

The JD5X series distribution unit replaces the J50 Junction Unit in an AP50 Autopilot Plus System.

The Plus System is made for steering gears with dual analog control or direct operation of dual directional valves.

The JD5X units contain the steering computer and interface circuits to all system components. Depending on model it contains drive circuits for directional valves or analog steering gears. The following models are available: JD50 (low DC solenoid supply), JD51 (high DC solenoid supply), JD52 (AC solenoid supply) and JD53 (analog output).

Refer to the AP50 Installation Manual P/N 20222410 (Plus System).

1.7 Rudder Feedback Units

RF300 Rudder Feedback Unit

This rudder feedback unit with transmission link and 10 m (30 feet) of cable transforms the angular travel of the rudder to a digital signal read by the autopilot steering computer. It is to be used on small to medium size vessels.

RF45X Rudder Feedback Unit

This rudder feedback unit with T45 transmission link and 2 m (6 feet) of cable transforms the angular travel of the rudder to a digital signal read by the autopilot steering computer. It is to be used on medium to large size vessels.

RF14XU Rudder Feedback Unit

This unit can replace the RF45X Rudder Feedback Unit in installations where a more rugged construction of the feedback unit is preferred. Besides electronic circuitry to generate feedback signals for the autopilot and rudder angle indicators it has been provided with 2 sets of limit switches.

1.8 Heading Sensors

The AP50 autopilot system can be used with the following combinations of heading sensors:

RC25 Rate Compass

The fluxgate compass with an integrated rate of turn sensor provides a dramatic improvement to the dynamic performance of both the autopilot and any stabilized radar display.

CD100A Course Detector and CDI 35 Course Detector Interface

The sensor and interface unit connects the AP50 system to a magnetic compass. The AP50 provides excitation current for CD100A and converts the analog sine/cosine signal to digital two-wire format for the autopilot steering computer.

General NMEA Compasses

Any compass outputting a NMEA 0183 message with either HDT, HDG, or HDM sentence can be connected directly to the J50/J50-40 junction units or to the NI300X NMEA Interface. An output of 10 Hz is recommended.

HS52 GPS Heading Sensor

The Simrad HS52 is a GPS compass that displays true heading output with position, velocity, and rate-of-turn information. This product replaces several vessel instruments in one compact package (gyrocompass, GPS system, and speed input).

The HS52 comprises three components: the sensor unit, the interface unit, and the display unit.

The sensor unit contains two GPS sensors and an inertial element. This unit is to be mounted on the vessel mast. The interface unit contains the main CPU and serial interface with high-speed communication. The display unit contains a LCD for navigation information and buttons for user control and command. The interface unit and the display unit may be mounted on the bridge. Refer to the HS52 manual.

Other Compass Models

GI51 Gyro Interface

This interface unit connects the geared synchro and stepper gyrocompass and the 200p/NM speed log to the AP50 system. Utilize the repeater signal output from the gyrocompass and the pulse output from the speed log to generate a speed and heading signal on NMEA format. GI51 is easily connected via Robnet.

1.9 Optional Equipment

A series of options are available for the AP50 system.

AP51 Remote Control

This portable remote control unit for AP50 with 7 m (23 ft.) of cable can be used as a hand-held remote control or can be mounted in a fixed bracket-mount.

The JP21 Jack Point can be used for simple connection/disconnection of the AP51 at different locations on the vessel.

Refer to the AP51 manual.

R3000X Remote Control

This small hand-held remote control has two buttons for power steering and course selection (port and starboard) and one button with a built-in lighted indicator for (limited) mode selection.

JS10 Joystick

The JS10 Joystick is a Non-Follow-Up steering lever designed for indoor and outdoor console mount. It has a spring-loaded return-to-mid-position feature and is equipped with 10 m (33') of cable and installation hardware.

QS50 QuickStick

The QS50 Quick Stick is a 2 axis joystick for arm rest and desktop mounting and is interfaced to the autopilot via Robnet. Mode change is made directly with the joystick and by means of push buttons thruster and WORK mode can be toggled On/Off.

NFU power steering is provided with an automatic center rudder function.

Refer to the QS50 manual.

S35 NFU Steering Lever

The S35 is designed for indoor and outdoor bulkhead-mounting and is made of shock resistant polyxymethylene. The lever has a spring loaded return-to-mid-position feature. Its push button with light indicator is used for (limited) mode selection when connected to an autopilot junction unit.

S9 NFU Steering Lever

The S9 is a splash proof steering lever for bulkhead or console mounting. The housing is made of machined aluminum. The internal mechanism of the S9 permits locking of the lever in the mid-position to avoid inadvertent operation. When the S9 handle is pulled out, the autopilot will be disengaged. When connected to the AP50, the S9 can also be wired for direct NFU override steering.

FU50 Follow-Up Steering Lever

The FU50 Follow-up steering lever features a dial (scale) with 5° rudder angle markings. The rudder will move and stop at the angle selected on the dial. The FU50 has a mid-position indent, buttons for (limited) mode selection, and mode indicators (STBY, FU, AUTO, NAV, WORK, and THRUSTER). It is designed for indoor and outdoor bulkhead- or panel-mounting. Refer to the FU50 manual.

TI51 Thruster Interface

The TI51 Thruster Interface is designed to offer control of a single thruster from an AP50 system. Operation of on/off solenoids, continuous control (voltage or current), proportional directional control and control of a Sauer Danfoss PVEM valve is provided. The thruster output signal is calculated in the TI51 based on operational mode and heading information received over Robnet from other system units. Set-up from the control unit and errors in the thruster interface are communicated via the Robnet. All thruster settings in the AP50 Control Unit are stored in the thruster interface unit.

Refer to the TI51 manual.

AD50 Analog Drive

The AD50 Analog Drive is designed to provide a control signal for operating an analog rudder in an AP50 system by either analog or proportional $\pm 10V$ control, or Danfoss PVEM valve. The analog rudder output signal is calculated in the AD50 based on operational mode and heading information received over Robnet from other system units. Set-up from the control unit and errors in the analog rudder interface are to be communicated via Robnet. All settings are stored in the analog rudder interface unit.

Refer to the AD50 manual.

RI35 Mk2 Rudder Angle Indicator

The RI35 Mk2 is manufactured in non-corrosive aluminum with a non-reflective black finish.

The instrument gives a continuous reading of the rudder position up to 45 degrees to each side of midship position. A front panel key is used for rudder zero-adjustment, deflection reversal, and illumination adjustment.

The splash-proof construction allows panel-, bulkhead-, or bracket-mounting in exposed locations, such as the bridge wings, the wheel house, and the engine room.

Refer to the RI35 Mk2 manual.

RI 9 Rudder Angle Indicator

The RI9 is manufactured in non-corrosive aluminium with a non-reflective black finish. The indicator is made in standard modular size (144x144 mm).

It is designed to operate from both voltage and current signals.

The instrument gives a continuous reading of the rudder angle up to 45 degrees on either side of the midship's position. (60, 70 or 90° as option).

The water tight construction allows bulkhead or desk mounting in exposed locations, such as bridge wings as well as wheelhouse and engine room.

NI 300X NMEA Interface Unit

This interface unit with 4 NMEA In/Out ports for communication with other systems and a selectable heading output for radars (Anritsu or Furuno), includes two Robnet connectors for the AP50 system.

2 OPERATION OF THE AUTOPILOT

Caution !

An autopilot is a very useful navigational aid, but it DOES NOT under any circumstance replace a human navigator.

Do not use automatic steering when:

- *In heavy traffic areas or in narrow waters*
- *In poor visibility or extreme sea conditions*
- *When in areas where use of autopilot is prohibited by law*

When using an autopilot:

- *Do not leave the helm unattended*
- *Do not place any magnetic material or equipment near the magnetic or fluxgate compass used in the autopilot system*
- *Verify the course and position of the vessel at regular intervals*
- *Always switch to Standby mode, and reduce speed in sufficient time to avoid hazardous situations*

2.1 Overview

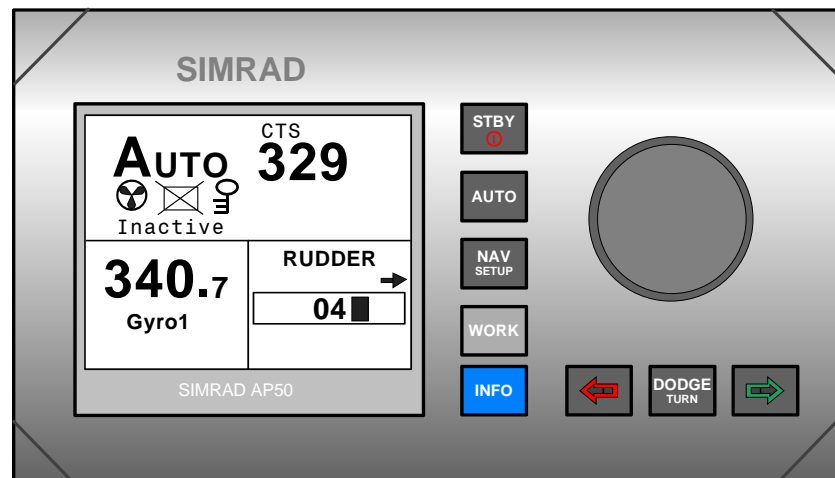



























Figure 2-1 AP50 Front Panel

Buttons	Action	Function
	Short press:	Switches the system on. Selects STANDBY mode.
	Long press (3 sec.):	Switches the system off.
	Quick double press:	Locks or unlocks other control units and levers in the system.

Buttons	Action	Function
	Single short press:	Selects AUTO mode and sets the heading reference.
	Second short press	Sets new heading reference (Heading catch)
	Short press:	Selects NAV mode prompt screen from AUTO mode. Verifies new course to steer when alert screen is shown (can also use the course knob, see below).
	Quick double press:	Selects User Set-up menu for selected mode.
	Long press (5 sec.):	Selects Installation menu.
	Short press:	Selects AUTO-WORK mode when in STANDBY mode. Selects/deselects AUTO-WORK mode when in AUTO mode. Selects/deselects NAV-WORK mode when in NAV mode.
	Short press:	Selects Instrument screens.
	Long press (5 sec.):	Selects units to be displayed.
	Quick double press:	Selects Instrument screens to be shown.
	Short press:	Activates Dodging.
	Long press (3 sec.):	Activates U-turn.
	Second long press:	Activates C-turn.
	Press in STANDBY mode:	Rudder moves to port while button is pressed.
	Press in AUTO mode:	Adjusts course to port (1°, 5°, or 10°).
	Press in User Set-up or Installation menus:	Reverts to previous menu item.
	Press in STANDBY mode:	Rudder moves to stbd. while button is pressed.
	Press in AUTO mode:	Adjusts course to starboard (1°, 5°, or 10°).
	Press in User Set-up or Installation menus:	Proceeds to next menu item.

Buttons	Action	Function
	Press simultaneously	Activates Follow-up steering mode.
 Course knob	Rotate in Follow-up steering mode: Rotate in AUTO mode: Rotate in NAV mode: Rotate in DODGE mode: Rotate in User Set-up or Installation menus:	Sets commanded rudder angle. Counter clock-wise = Port course change Clock-wise = Starboard course change Verifies new course to steer when alert screen is shown. Presets heading Adjusts or confirms reading.

Screen Symbol	Description
	Rotate course knob
	Press  (PORT) or  (STBD) button
04 	Rudder angle 4° to starboard (Rudder command when analog rudder)
102	Rudder angle 2° to port (Rudder command when analog rudder)
	Rudder command to starboard
	Rudder command to port
	Thruster connected to autopilot system
	Control unit inactive or disengaged
	Control unit locked
	Key symbol alternates with mode index on unlocked master unit
	No course changes can be made unless you press the  (AUTO) button
	Cross track error to starboard
	Boat turning to starboard

The control unit shown in Figure 2-1 on page 9 can operate as a stand-alone unit in an autopilot system or it can be combined in a multistation system. In a multistation system, command can easily be transferred from one unit to another and units not in control will display "Inactive".

The autopilot system may also be disabled from the ships' steering system with an external switch. This will totally disengage the autopilot system from the ships' main/emergency steering system and the units will display "DISENGAGED".

The AP50 system is capable of the following primary steering modes with each mode having a dedicated push button: STANDBY (Follow-up and Non-Follow-up), AUTO, NAV and DODGE. AUTO and NAV modes also have a sub-mode that is accessed by pressing the WORK button. The AUTO-WORK and NAV-WORK sub-modes are used under operational conditions different from those normally found when a vessel is in transit on a preset course (e.g. trawling, towing, trolling on one engine, slow speed, using a thruster, etc.).

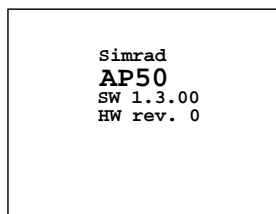
Each of the mode buttons is clearly identified with the primary function in large text and a secondary function listed in smaller text. Each button provides you with the ability to access a primary display, a secondary display, and/or multiple function displays.

A group of user-adjustable settings belonging to the selected mode are provided in the AP50 User Set-up Menu (see page 29). The settings allow adjustment of display visibility, selection of heading sensor, navigation and position sources, and the ability to select between automatically or manually adjustable sea state filter.

Alarms are presented in plain text to alert you to both system and external data failure conditions. Alarms include both audible and visual presentations. The alarms are listed on page 45.

2.2 ON/OFF - Standby Mode (STBY)

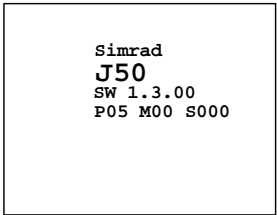
A single press on the  (STBY) button switches the system ON and the following status displays are shown:



Autopilot model


Software version (1), release (3), minor change (00)


Hardware revision



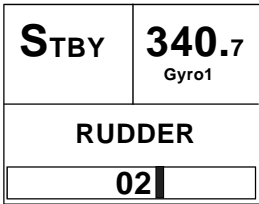
Junction unit model
Software version (1), release (3), minor change (00)
Power board revision, Main board revision and Self check
(SW and HW revisions shown are examples only)

After approximately 5 seconds, the system is operative and the unit that was turned on will show the STANDBY mode display. Other units in a multistation system will display "Inactive". Control can be transferred to any single unit by pressing any of its' mode buttons (except in a Wheelmark system; see the Introduction on page 1).

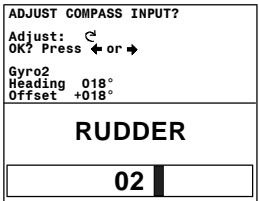
A long press (3 sec.) on the  (STBY) button switches the system off and during this time, the alarm will sound.

Note ! *In an emergency, it is possible, on a multistation system, to turn OFF the system at any control unit by pressing the  (STBY) button for 3 seconds (except in a Wheelmark system).*

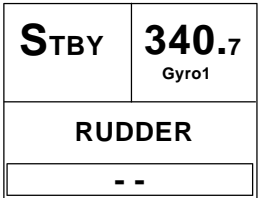
STANDBY mode is used when steering the boat at the helm.



- Display information:
- Standby mode
 - Current heading from gyro 1: 340.7°
 - Rudder angle: 2° to starboard. When there is no rudder feedback signal (analog rudder drive) the rudder readout shows – –).




Stepper or Synchro gyro



Analog rudder

If a stepper or synchro gyro is connected to the autopilot system via the GI51 Gyro Interface, a display for the heading adjustment is presented at Power On or at change of compass in the User Set-up menu. Use the course knob to align the autopilot read-out to correspond with the gyro heading. Check the alignment every time the autopilot/gyro is switched on. If two stepper gyros are connected, both will simultaneously be aligned. A stepper gyro used as monitor compass will automatically be aligned to the steering compass.

Press the  (PORT) or  (STBD) button to proceed to Standby mode.

If the inactive symbol  is shown (when powered up from FU50 or while Disengaged) the Control unit must be activated before alignment by pressing the STBY button.

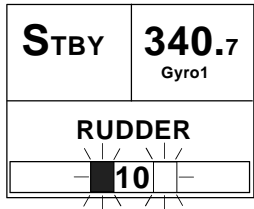
2.3 AP50 with MSD50 Stern Drive unit

Note ! *The information in section 2.3 only applies if your autopilot is driving a Simrad MSD50 Stern Drive.*

The MSD50 Stern drive unit has a relative feedback signal which needs a zero point setting after the autopilot has been turned on. Refer to the MSD50 manual for further information.

Zero point setting

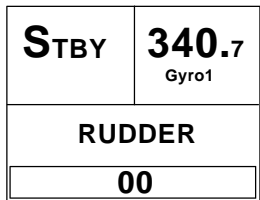
Note ! *If you do not need a rudder angle display when leaving the dock, just steer the boat manually on a straight course and press the AUTO button. The zero point is then set automatically.*



If you prefer to use the rudder angle display when leaving the dock, proceed as follows:

After turn on the rudder angle display will alternate between 10 degrees port and starboard to indicate that the "rudder" zero point need be set.

Use the wheel to bring the "rudder" to midship position. Turn the wheel from lock to lock (H.O. to H.O.) and count the exact number of turns. Then start from one lock position and turn the half number of turns.





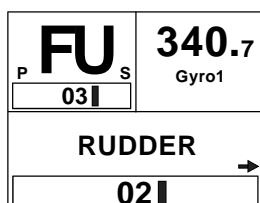
Press the AUTO button and then the STBY button. The zero point is now set and the following display is shown.

Operation

Follow the operating instructions on the following pages. There is no further need for zero point settings until next time you turn the autopilot on.

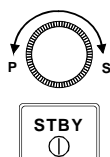
2.4 Follow-Up (FU) Steering

When both the  (PORT) and  (STBD) buttons are pressed simultaneously, the AP50 will enter Follow-Up steering mode and the course knob may be used to set rudder commands. One revolution of the knob equals a 45° rudder change. The rudder will move to the selected angle and stop.




Display information:

- Follow-Up mode
- Commanded rudder angle: 3° to starboard
- Rudder angle: 2°
- The small starboard arrow shows that the rudder is moving.

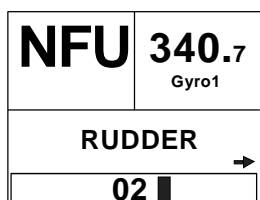




Use the course knob to select the rudder angle.

Return to manual control in Standby mode by pressing the  (STBY) button.

While in Follow-Up mode, you cannot take manual control of the vessel unless you use the External Mode Selector.

2.5 Non-Follow-Up (NFU) Steering



In STANDBY mode, the NFU display is presented when either the  (PORT) or  (STBD) button is pressed. The rudder will move as long as the button is pressed and the actual rudder angle is shown on the display. The small arrow shows that the rudder is moving.

Note !

When a NFU steering lever or remote control is operated, the control unit(s) become "Inactive".

For safety reasons NFU steering is not possible when an analog rudder control is provided via an AD50 Analog Drive

S9 (NFU) Steering Lever

The S9 Steering Lever has a “Starboard-Port” rudder command movement and an “In-Out” movement. When pulled out, starboard and port rudder commands are enabled. When pushed in, the lever becomes locked in the center position.

When wired accordingly, the S9 can also perform mode changes and operate as a priority control.

Observe the autopilot display when operating the S9.

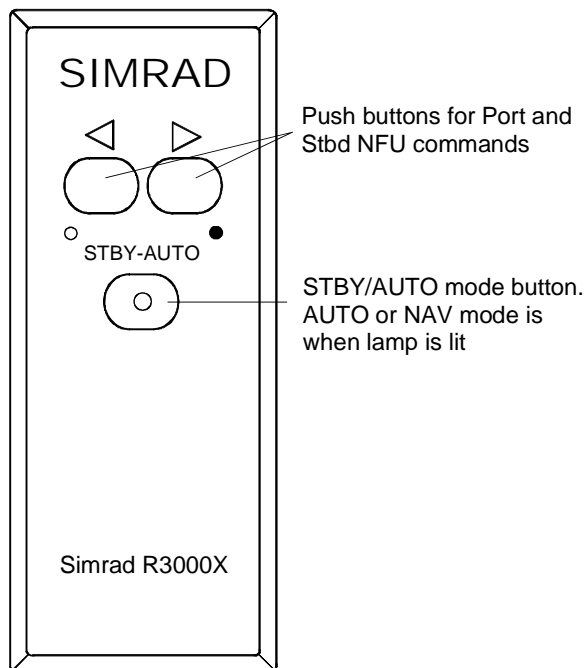
JS10 (NFU) Joystick

In STANDBY mode, the rudder will move as long as the lever is offset to Port or Starboard.

F1/2 (NFU) Push Button Remote Control

In STANDBY mode, the rudder will move as long as the Port or Stbd button is pressed.

R3000X Remote Control (NFU)



In STANDBY mode, the rudder will move as long as the Port or Stbd button is pressed.

In AUTO mode the set course will change 1° each time the button is pressed. Changing set course is indicated by beeps on the AP50 Control Unit.

Note!

If you keep the button pressed, it will automatically change the course in increments of 3° per second.

Pressing the mode button returns the autopilot to the initial mode, except when in NAV mode:

AUTO → STBY → AUTO

AUTO-WORK → STBY → AUTO-WORK

NAV → STBY → AUTO

NAV-WORK → STBY → AUTO-WORK

Note !

NAV mode can only be entered from a control unit or AP51 Remote Control Unit.

S35 NFU Steering Lever

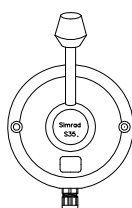
STANDBY:

The rudder will move as long as the lever is offset to Port or Starboard (Non-follow-up steering).

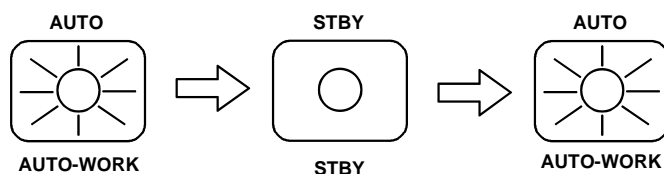
AUTO/AUTO-WORK: The set course will be changed by 3° per second when the lever is offset to Port or Starboard or 1° for single activation.

Changing set course is indicated by beeps on the AP50 Control Unit.

The mode button remains lit as long as the autopilot is in AUTO or AUTO-WORK mode (and NAV mode).



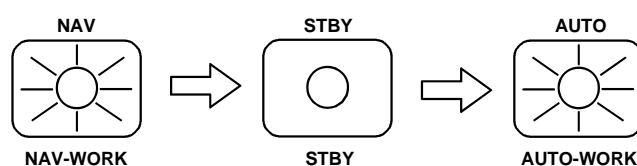
The mode change sequence is as follows:



Pressing the mode button returns the autopilot to the initial mode at the present course.

NAV/NAV-WORK:

It is not possible to change the set course by the lever. Pressing the mode button brings the autopilot to **STANDBY** mode, but the next press brings it to **AUTO** mode, not back to NAV mode.



Note !

NAV-WORK mode can only be entered from a control unit or AP51 Remote Control Unit.

2.6 Automatic Steering



AUTO Mode



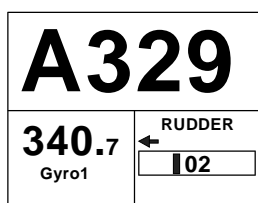
AUTO mode is used to make the AP50 steer the vessel automatically on a set heading. AUTO mode is always available from any mode or function within the AP50 by a single push of the AUTO button. When AUTO mode is selected, the AP50 automatically selects the current vessel heading as the set heading and the rudder will move to midship position.

The **W Init rudder** setting has no effect.

In AUTO, the AP50 issues rudder commands to keep the boat on the set heading. The boat heading is provided by the steering compass.

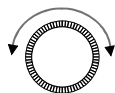
The AP50 will keep the boat on the set heading until a new mode is selected or a new heading is set with either the course knob, the  (PORT) or  (STBD) buttons, or by pushing the AUTO button again. One revolution of the knob equals a 45° course change.

Once the course is changed to a new set heading, the boat will automatically turn to the new heading and continue to steer straight.



Display information:

- Automatic steering mode
- Set heading: 329°
- Boat heading from gyro compass: 340.7°
- Rudder angle: 2° to port and still moving



Rotate the course knob to change the course:

Clock-wise = Starboard course change

Counter Clock-wise = Port course change



Press the PORT or STBD button to adjust the course by 1°. It is possible to set the buttons to adjust the course by 5° or 10° per press (Refer to the Installation Manual, *Installation Menu/Settings/Course adjust*).



Press the AUTO button to select current vessel heading as set heading.



Press the STBY button to regain manual steering

AUTO-WORK Mode

The AUTO-WORK mode is an automatic steering mode to be used under operational conditions different from those normally found when a vessel is in transit on a pre-set course. Examples are trawling, towing, trolling on one engine, slow speed etc.




In such situations, some boats may need different settings. By pressing the WORK button, a separate set of steering and turning values will be used. It can also be set how the rudder should move when entering AUTO-WORK from STANDBY or DODGE.


If **W Init Rudder** “Actual” is selected (Refer to the Installation Manual, *Installation Menu/Settings/W Init Rudder*), the rudder offset is maintained and becomes the **Trim** value (bumpless transfer).

If **W Init Rudder** “Midship” is selected, the rudder will move to midship (0°).

When selecting WORK from any automatic mode and when changing between heading and route steering, the rudder offset is always maintained.

To manually change the **Trim** or other WORK settings, quickly double press the  (NAV/SETUP) button (see AUTO-WORK mode in the User Set-up menu on page 34).

*If **Thruster** is selected under the **Steering function** in the User Set-up Menu, the thruster will be used when selecting WORK mode.*

Aw 329	
340.7 Gyro1	RUDDER 

Display information:

- AUTO-WORK mode
- Set heading: 329°
- Boat heading from gyro compass: 340.7°
- Rudder offset of 4° to port becomes the **Trim** value

If you prefer to have complete manual control of the rudder trim in AUTO-WORK mode, the **Autotrim** can be permanently disabled in the Installation Settings menu (Refer to the Installation Manual, *Installation Menu/Settings/Autotrim*).

Caution !

The Off Heading alarm is permanently disabled in AUTO-WORK mode.

Note !

Pair-trawling requires manual trim only, and the autotrim should be permanently disabled at the Installation Settings menu.

2.7 Thruster Steering

If the vessel is equipped with a thruster, it can be connected to the AP50 system and the vessel can then be controlled by rudder, thruster, or both rudder and thruster.

After connecting a thruster to the autopilot system (see the TI51 manual) the thruster type must be selected under the Installation Dockside menu (ref. AP50 Installation Manual).

A thruster icon below the mode index indicates that a thruster is connected to the system.

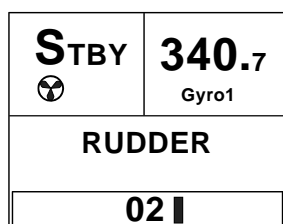
Now you can select one of three control functions from the User Set-up Menu:

- **Rudder:** The rudder is used to maintain the heading (always in AUTO mode and NAV mode).
- **Thruster:** The thruster is used to maintain the heading (only in AUTO-WORK, NAV-WORK, Follow-up, and Non-Follow-up steering modes).
- **Rudder and Thruster:** Both rudder and thruster are used to maintain the heading (only in AUTO-WORK mode, NAV-WORK mode, Follow-up and Non-Follow-up steering modes).

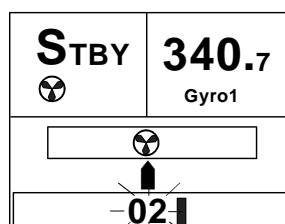
Examples of display pictures:

STANDBY mode

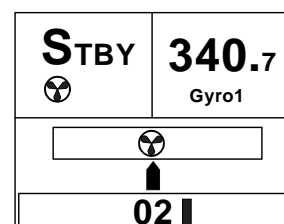
(Follow-up and Non-follow up steering modes)



Heading to be maintained by rudder

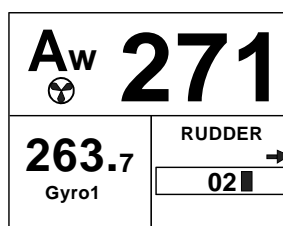


Heading to be maintained by thruster

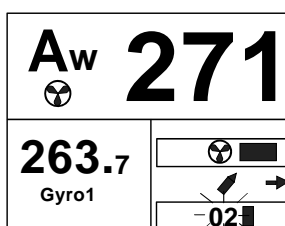


Heading to be maintained by rudder and thruster

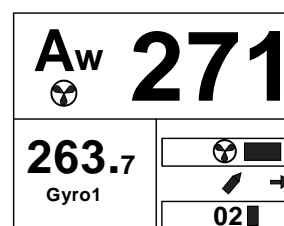
AUTO-WORK mode



Heading maintained by rudder



Heading maintained by thruster



Heading maintained by rudder and thruster

Caution !

When operating an On/Off thruster it is important to note that most electrical thrusters have a built in thermal cut-off switch that will shut off the electromotor if it is overheating and re-engage it when it has cooled down. The water temperature also affects the running time. The On/Off thruster may only run for a few minutes, and its total running time for a longer period should be limited by increasing the thruster sensitivity value (Refer to the Installation Manual, Installation Menu/Settings/Thruster/Thruster Sens).

2.8 Navigating with the AP50

The AP50 has the capability to use steering information from an external navigator (GPS/Chart plotter or ECS) to direct the boat to one specific waypoint location or through a series of waypoints. In the NAV mode, the AP50 uses the heading sensor as its heading source for course keeping. The steering and speed information received from the external navigator alters the set course to direct the AP50 to the destination waypoint.

Note !

Navigational steering must only be used in open waters. By selecting the NAV mode, the AP50 is set for automatic steering on the current set course to a destination waypoint.

To obtain satisfactory navigation steering, the following conditions must be fulfilled prior to entering the NAV mode:

- The AP50 autosteering must be tested and determined satisfactory

- The navigation receiver must be operating and the navigation system (GPS/Chart plotter or ECS) must be in full operating mode with adequate signal characteristics for valid position and steering data
- At least one waypoint must be entered and selected as the current waypoint in the navigation receiver
- The navigation source in the AP50 User Set-up menu must be set for the navigator that contains the current waypoint

The AP50 is designed to steer in mixed mode operation. This combines the straight steering capability of Cross Track Error (XTE) steering in conjunction with the turning capability of bearing mode steering (Course To Steer [CTS]).



Press the NAV button to activate the NAV prompt display.

WP :	SIMRAD
BWW :	270°
Chg :	← 70°
OK? Press NAV	
340.7 Gyro1	RUDDER 101

The upper half of the prompt display shows the name of the next waypoint (WP), the bearing to the waypoint (BWW), and the required course change (Chg) with the direction in which the vessel will turn.

The lower left portion shows the compass heading and the lower right portion shows the rudder angle and port direction.



Press NAV to accept the first waypoint as the location to steer towards. The autopilot turns the boat onto the new course.

N	CTS 340°
	GPS1 I
	XTE .000 NM
340.7 Gyro1	NEXT WP SIMRAD BPW 340° T DST 25 NM

Display information:

- NAV mode
- Course To Steer (CTS): 340° is set internally in the autopilot to steer the boat along the track
- Nav source: GPS1. The boat is located on the track
- Cross Track Error (XTE): 0.000 nautical mile

Note !

For Cross Track Error, the number of decimals shown depends on the output from the chart plotter. Three decimals give a more precise steering than two. Four decimals from chart plotter are shown as three decimals on the display.

- Compass heading from Gyro1: 340.7°
- Next waypoint: Simrad
- Bearing from the current position to the next waypoint (BPW): 340°
- Distance to this waypoint: 25 nautical miles

Route Navigation

When operating the AP50 in NAV mode to automatically steer through a route of waypoints, the AP50 will steer to the first waypoint in the route after you accept the first waypoint as the location to steer towards.

WP:	WP2
BWW	100°
Chg.	← 035°
OK? press NAV	
135.7 Gyro1	NEXT WP WP2
	BPW 102°T
	DST 02.2 NM

If you use a GPS/Chart plotter, the AP50 will, when you arrive at the waypoint arrival circle, output an audible alarm and display an alert screen with the proposed new course information. If the required course change is more than 10°, you will need to verify that the upcoming course change is acceptable.



Verification is performed by pressing the NAV button or turning the course knob after the alert screen is displayed. If an external alarm unit (optional) is connected to the AP50 system, an alarm is given after 5 seconds. If no verification is received, the AP50 will continue on the current set course in NAV mode.

Regain manual steering at any time by pressing the (STBY) button.

If “END ROUTE” is used as final WP-name, an “End of route” warning will be given on the active control unit when arriving at the final WP.

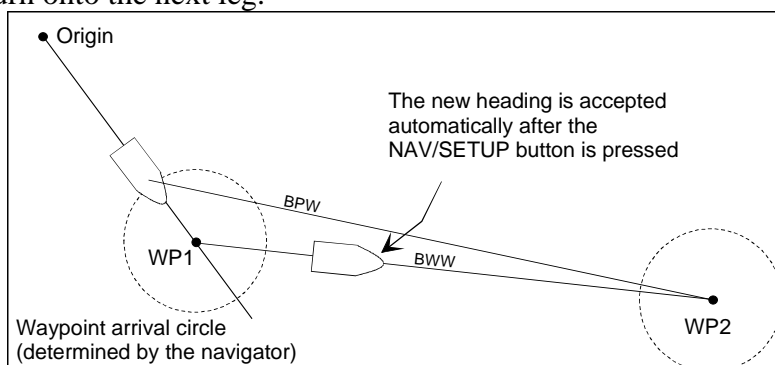
Note !

If the AP50 is connected to a navigation receiver that does not transmit a message with the bearing to the next waypoint, it will pick a Cross Track Error message and steer on Cross Track Error only. In that case you have to revert to AUTO mode at each waypoint and manually change the set course to equal the bearing to the next waypoint and then select NAV mode again.

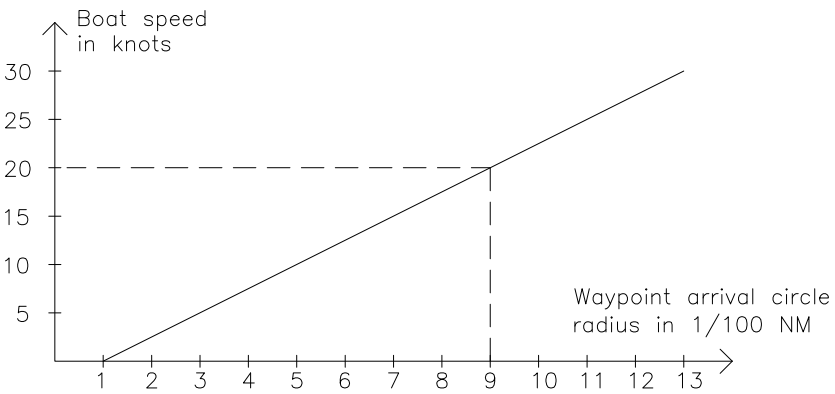
Setting the waypoint arrival circle

For route navigation it is recommended to use automatic waypoint shift/change at a set waypoint arrival circle.

The arrival circle should be adjusted according to boat speed. The higher speed, the wider circle. The intention is to make the autopilot start the heading change in due time to make a smooth turn onto the next leg.



The figure below may be used to select the appropriate waypoint circle on the GPS/chartplotter.



Example: With the speed of 20 knots you should use a waypoint circle with radius 0.09 NM.

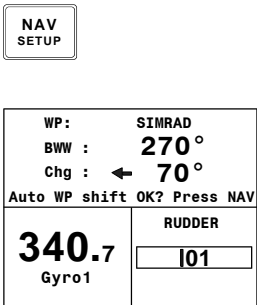
Note !

The distance between any waypoints in a route must not be smaller than the radius of the waypoint arrival circle when using automatic waypoint shift.

Electronic Chart System (ECS)

An ECS has to be selected as NAV source.

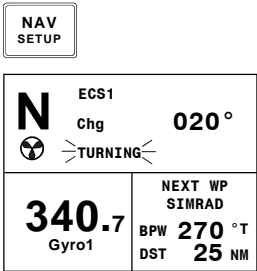
Press the NAV button to activate the NAV prompt display.



The upper half of the prompt display shows the name of the next waypoint (WP), the bearing to the waypoint (BW), and the required course change (Chg) with the direction in which the vessel will turn.

The lower left portion shows the compass heading and the lower right portion shows the rudder angle and direction.

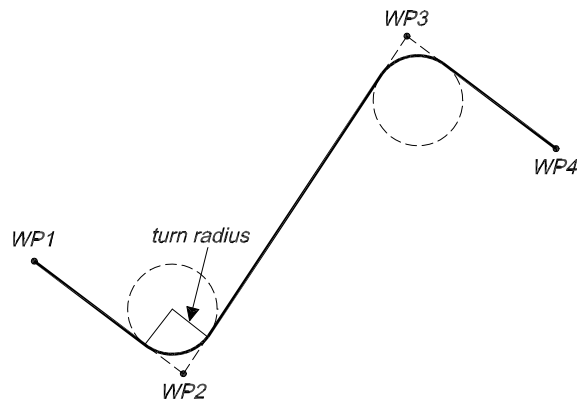
Press NAV to accept the first waypoint as the location to steer towards. The autopilot turns the boat onto the new course while the display flashes “TURNING”.



Accepting the first waypoint as the location to steer towards you also accept the autopilot to automatically steer the boat through the route of waypoints. When the autopilot changes the course at each waypoint, the display flashes “TURNING”.

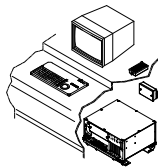
If you wish to confirm the new heading at each waypoint, GPS has to be selected as NAV source.

A route consists of a series of waypoints joined together with straight legs. Each waypoint in a route, except the first and the last, has an associated turn radius defined. This turn radius will allow the ship to turn before the waypoint is reached.



Caution !

If an ECS is selected as a navigator, the course change verification is waved. This is done so the AP50 is capable of following a route in which the radius of the course change is pre-set in the chart system. Users navigating in this mode must use extra caution.



Selecting a Different Navigator

If you have more than one navigation source connected to the AP50, you may choose any for navigation. Refer to the User Set-up menu in Standby mode for details on selecting a different navigator (see page 30).

NAV-WORK Mode

Like the AUTO-WORK mode the NAV-WORK mode is an automatic steering mode to be used under special steering conditions (Refer to AUTO-WORK mode).

When the boat is on a track line in AUTO-WORK mode, and the NAV button is pressed, the boat is steered in Navigation mode and the Work parameters are maintained (Trim etc.).

A corresponding display is shown:



Nw	CTS 280°
	GPS1
	XTE .023 NM
340.7 Gyro1	NEXT WP SIMRAD
	BPW 280° T DST 25 NM

Display information:

- NAV-WORK mode
- Course to steer (CTS): 280° is set internally in the autopilot to steer the boat on to the track. This course is calculated by the autopilot to provide a suitable approach to the track. It is also affected by settings made at the sea trial (Refer to the Installation Manual, *Installation Menu/Settings/ Init NAV*)
- Navigation source: GPS1. The boat is located on the starboard side of the track
- Cross track error (XTE): 0.023 nautical mile
- Compass heading from Gyro1: 340.7°

- Next waypoint (Next WP): Simrad
- Bearing from current position to next waypoint (BPW): 280° (True)
- Distance to waypoint (DST): 25 nautical miles

If you prefer to have complete manual control of the rudder trim in NAV-WORK mode, the autotrim can be permanently disabled in the Installation Settings menu (Refer to the Installation Manual, *Installation Menu/Settings/Autotrim*).


Caution !

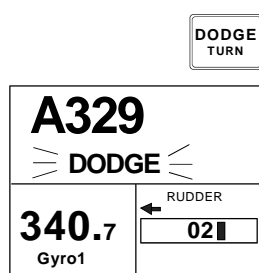
The Off Heading alarm is permanently disabled in NAV-WORK mode.


2.9 Dodging

Dodging in AUTO Mode

The AP50 provides the capability for dodging.


Dodging is useful in situations when you need to quickly take control of the helm to steer around an obstruction and then wish to return on the previous set heading after performing the evasive maneuver. A quick press on the  (DODGE/TURN) button activates dodging.



When in DODGE mode, the set course is displayed (for example, as A329 degrees) and this set course is remembered by the AP50. When DODGE is flashing on the display, the AP50 is no longer in control of the steering and you must either steer the boat manually or take control using Non-Follow-Up steering or Follow-Up steering. The current heading will be shown in the lower left part of the display (for example, as 340.7 from Gyro1). On manual steering, the clutch (or bypass valve) in the drive unit will be disengaged when dodging. The AP50 will remain in the DODGE mode until you exit DODGE by a second press on the  (DODGE/TURN) button or until you select another mode.

Perform dodging as follows:



1. Press  (DODGE/TURN) button quickly

2. Manually steer the vessel by wheel: 

or

Non-Follow-Up:  or  or NFU steering lever.

or

Follow Up: Both   and course knob.

To preset a new Course, rotate course knob (Not possible in Follow Up).

To return from DODGE mode, press one of the following:



Selects AUTO mode with the last set or new preset course.



Selects AUTO mode with the current heading as the set course.

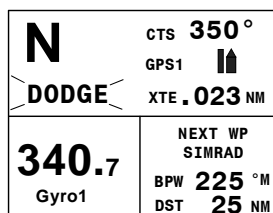
Note !


If using Non-Follow-up or Follow-up steering modes while dodging, “NFU” or “FU” flash.

Dodging in NAV Mode



A quick press on the  (DODGE/TURN) button activates dodging.



When in DODGE mode, the course displayed as Course To Steer (CTS) is the boat’s recommended heading. However, the previous set course is stored by the AP50. When DODGE is flashing on the display, the AP50 is no longer in control of the steering and you must either steer the boat manually or take control using either Non-Follow-up steering or Follow-up steering. On manual steering, the clutch (or bypass valve) in the drive unit will be disengaged when dodging. The AP50 will remain in the DODGE mode until you exit DODGE by a second press on the  (DODGE/TURN) button or until you select another mode.

Perform dodging as follows:

1. Press  (DODGE/TURN) button quickly

2. Manually steer the vessel by wheel:
or



Non-Follow-up:



or



or

NFU steering lever.

or

Follow-up: Both   and course knob.

To return from DODGE mode press one of the following:



Returns to NAV mode at the current track.
(May result in a drastic course change).



Selects AUTO mode with the current heading as the set course.



Selects NAV mode at present position with new bearing to waypoint prompt.

Note ! *If using Non-Follow-up or Follow-up steering modes while dodging, “NFU” or “FU” flash.*

2.10 TURN Mode

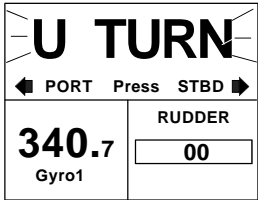
U-turn





The AP50 provides a special U-turn feature when in AUTO or AUTO-WORK modes.

U-turn changes the current set course 180° in the opposite direction. The user must decide whether the U-turn should be made to Port or Starboard when bringing the boat on the new course.



A long press of the  (DODGE/TURN) button activates U-Turn.



The AP50 will continue on the set course until you press either the  (PORT) or  (STBD) button to select the direction in which to make the U-turn. If you do not press  (PORT) or  (STBD) within 1 minute, the AP50 will return to the AUTO mode and stay on course.

C-turn

The AP50 also provides a continuous turn feature when in AUTO or AUTO-WORK modes. This may be used for circling fish, purse seining, etc.

C-turn makes the vessel turn with a constant rate of turn in a circle. The user must decide whether the C-turn should be made to Port or Starboard.

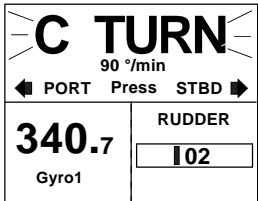
To enter C-turn mode:



First select U-turn with a long press of the DODGE/TURN button.



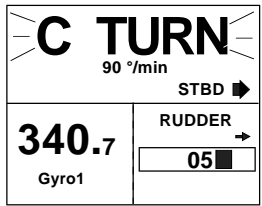
Then activate C-turn by another long press of the DODGE/TURN button.



The AP50 will continue on the set course until you press either the PORT or STBD button to select the direction in which to make the C-turn. If you do not press PORT or STBD within 1 minute, the AP50 will return to AUTO mode and stay on course.

The turn rate can be adjusted either before the turn is initiated or during the turn. Increasing the turn rate yields a smaller circle and vice versa.

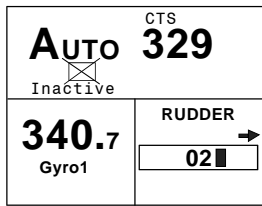
To exit C-turn mode, press any of the mode buttons. When



Vessel turning
starboard

pressing the AUTO button, the new set course is shown in the upper portion of the display.

2.11 Multiple Station System



Inactive control
unit

In the normal operation of multiple control units, control is accessible from every control unit and steering handle connected to the AP50 system. However, only one control unit is "active" at a time providing the user with access to all functions and enabling the user to change modes and to set the course for automatic course keeping. All remaining control units are "inactive" and have no effect on course selection. A single push on either the STBY, AUTO, or NAV buttons on an "inactive" control unit will allow the transfer of command to make it "active". To remain in the mode, press the current mode button.

Note !

On an inactive control unit, backlight and contrast can be directly adjusted through the course knob.

In Master Operation (Wheelmark) of multiple control units, one control unit must be set up for master operation. "Power on" capability is possible from any unit, but "power off" capability is only possible from the master unit (the unit on which Master Operation is set to "yes" in the Installation Dockside menu, (refer to the AP50 Installation Manual)). In Master Operation, the remote control units and handles are locked.

2.12 Lock Function

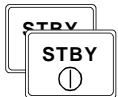
Standard Operation


The "LOCK" function is a safety feature included in the AP50 system to lock-out all control units except for a single, user-selected "active" control unit.

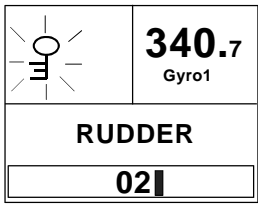
When the "LOCK" function is in use, no transfer of command may take place; only the "active" control unit stays in command.

Note !

On a locked control unit, backlight and contrast can be directly adjusted through the course knob.

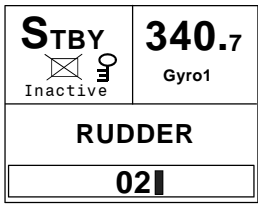


To enable the "LOCK" function, quickly double-press the  (STBY) button on the "active" unit.



Active control unit

The display on the "active" control unit will first show a single key icon followed by the primary display on which the key icon will alternate with the mode index (not when selected as Master station).



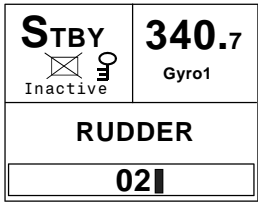
Inactive control unit

The "LOCK" function is unlocked by double-pressing the STBY button on the "active" control unit.



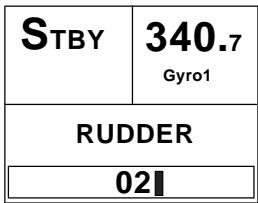
After having "unlocked" the "active" control unit, it will show this symbol before the display returns to normal. All other control units remain "inactive".


Master Operation




Remote units locked

In Master operation (Wheelmark), all remote units are locked at "power on". The key icon is shown on all remote units with LCD displays.

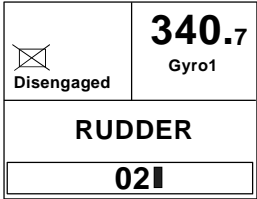


A quick double press on the master unit's  (STBY) button enables the remote units. This is indicated on the master unit by a flashing crossed key, while on the remote units, the key icon disappears.

The first remote unit that is activated takes control of the system. If the activated remote unit has a display, all other remote units are locked and units with a display will show the key icon. If the activated remote unit does not have a display (R3000X, FU50, S35, JS10), all remote units can be operated until a unit with a display is operated. Then, all other remotes are locked.

To unlock the locked remote units, you have to take control from the master unit by quickly double-pressing its  (STBY) button.


2.13 External system selection



An external system selector can be used to change from automatic to manual steering and vice versa (refer to IMO resolution MSC.64 sec.4). The selector switch must adequately indicate which method of steering is in operation at any given moment. When manual steering is selected, the AP50 will be disconnected from the vessel’s steering system and show “Disengaged” on the display (no mode indicators are lit on the FU50). When automatic steering is selected, the AP50 will go to AUTO mode (or AUTO-WORK mode). For connection of an external system selector switch, refer to “System Select”, in the AP50 Installation Manual.

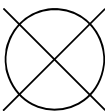
2.14 User Set-up Menu




In the AP50, the STANDBY, AUTO, and NAV modes have a User Set-up menu with adjustable settings. You can easily reach the set-up menus by a quick double press on the  (NAV) button from the mode you are currently in. Move through the menu items by pressing the Port and Starboard buttons. Use the course knob to change a value.

Note !

More in depth information about the various items in the User Set-up Menu can be found in the AP50 Installation Manual chapters 3 and 4.



Alternating Course Knob Icon

When the course knob is used for settings in the User Set-up menu, an icon will alternate on the screen to tell that no course changes can be made unless you press the  (AUTO) button.

STANDBY Mode

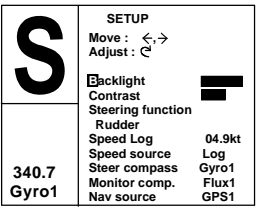
Backlight

The brightness of the backlight of the display and buttons may be adjusted (10 grades, 10 = brightest). The setting is stored when the system is turned off and resets to the stored level when turned on. Adjustment is local to the control unit you adjust.

Contrast

The contrast of the display may be adjusted (10 grades, 10 = highest contrast). The setting is stored when the system is turned off and resets to the stored level when turned on.

Adjustment is local to the control unit you adjust. At high temperatures, not all steps are available due to automatic temperature compensation.



Steering function

(only available if Thruster is selected in the Installation Dockside Menu).

Select between the following steering functions: The boat is steered by the rudder; by the thruster; or by a combination of the rudder and the thruster, dependent on the selected mode. In AUTO mode and NAV mode the rudder is always selected.

Speed (Man, Log, SOG)

The AP50 adapts to the speed of the vessel and this setting should be adjusted accordingly.

If a speed log or other speed source is not connected, the speed input can be set manually by the course knob with range from 1 to 70 Knots.

If an external speed source is selected, the current speed and source will be shown.

If an external speed source is selected but lost, an alarm will be given after 15 seconds and the manual speed will automatically be set to the last reading. If the external source speed again becomes available, the AP50 will again automatically use the external source speed.

Speed Source

Select the Speed source. If no speed source is available, set the speed source to Man (manual) and adjust for manual speed as per “Speed above”.

Steering Compass

Select the compass to be used for steering.

Monitor Compass

Select the compass to be used as the monitor compass if more than one compass is connected.

Nav Source

Select the source for navigational data.

AUTO Mode

Backlight

Same procedure as in STANDBY mode.

Contrast

Same procedure as in STANDBY mode.

<div style="font-size: 2em; font-weight: bold; text-align: center;">A</div>	SETUP	
	Move :	←,→
	Adjust :	↺,↻
	Backlight	■
	Contrast	■
	Steering function	■
341°	Rudder	AUTO
CTS	Seastate	0.50
340.7	Rudder	1.40
Gyro1	Count rudder	
	← More →	

Steering Function

(only available if Thruster is selected in the Installation Dockside Menu, see the AP50 Installation Manual).

Same procedure as in STANDBY mode.

Seastate

Seastate determines the number of degrees the vessel may fall off the set course before any rudder commands are given to the rudder.

Select the value for the Seastate filter:

OFF: Provides precise steering but increases rudder activity.

AUTO: Automatically reduces the rudder activity and sensitivity of the autopilot in rough weather.

MANUAL: Sets yaw band manually (MAN 1 - MAN 10, $10 \approx \pm 6^\circ$).

This setting determines the number of degrees the vessel may deviate from the set course before any command is given to the rudder. In calm weather, it should be set to “OFF”, which means that theoretically, the autopilot allows no deviation from the set course. The Seastate filter value should be increased with increasing sea turbulence. This will cause the sensitivity of the rudder to be decreased such that the vessel has to deviate from the set course by the number of degrees selected in the Seastate filter setting before a rudder command is given. The amount of rudder is calculated by the heading error exceeding the set limit, multiplied by the p-factor. This will prevent excessive rudder movement and reduce rudder activity.

Note !

In conditions where active steering is required, the Seastate filter value should be reduced.

Rudder

Rudder sets the rudder gain, which is the ratio between the heading error (p-factor) and the commanded angle. The default value depends on the boat length. The value (ranging between 0.05 and 4.00) is determined during Sea trial, but can easily be adjusted in the User Set-up menu.

Counter Rudder

Counter Rudder is the parameter that counteracts the effect of the boat's turn rate and inertia. The default value depends on the boat length. The value (ranging between 0.05 and 8.00) is determined during Sea trial, but can easily be adjusted in the User Set-up menu.

A	SETUP	
	Move :	←,→
	Adjust :	↺,↻
	Speed Log	04.9kt
	Off heading lim	03°
341°	Turn mode	ROT
CTS	RateOfTurn	240°/min
340.7	Thruster sens	01°
Gyro1	← More →	

Speed (Man, Log, SOG)

Same procedure as in STANDBY mode.

Off Heading Lim

Off Heading Lim sets the limit for the Off Heading Alarm. An alarm occurs when the actual heading deviates from the set heading more than the selected limit. The default setting is 10° and the range is 3 to 35°.

Turn Mode

Select either Rate of Turn (ROT) steering or Radius (RAD) steering. ROT is the default setting.

ROT/RAD

ROT/RAD sets the turn value for the selected turn mode.

The rate of turn range is from 5°/minute to 720°/minute and the radius range is 0.01 to 0.99 nautical mile.

The minimum radius can however, never be less than the value corresponding to a Rate of Turn = 720°/minute at the set Cruising speed.

The initial value is determined during Sea trial, but can easily be adjusted in the User Set-up menu.

Thruster Sens

(Only available if Thruster is selected in the Installation Dockside Menu)

The Thruster sensitivity determines how many degrees the vessel must deviate from the set course before a thruster command is given. As the vessel deviates from its heading, the thruster will push the vessel back. A higher value will reduce the thruster activity and extend the lifetime, especially for on/off thrusters.

If the thruster commands are hunting from side to side, the set value for **Thruster sens** may be too low.

If a low value for **Thruster sens** is needed, consider reducing **Thruster gain** to avoid hunting.

Range: Continuous thrusters 0° to 30° in 1° increments
On/off thrusters 3° to 30° in 1° increments.

Default: 1° for continuous thrusters, 5° for On/Off thrusters.

AUTO-WORK Mode



To enter the User Set-up menu when in AUTO-WORK mode, quickly double press the NAV button.

Aw	SETUP
	Move :
	Adjust :
	Backlight
	Contrast
341°	Steering function
CTS	Rudder
340.7	W Seastate
Gyro1	W Rudder
	W Count rudder
	← More →

The User Set-up menu for the AUTO-WORK is identical to the AUTO mode User Set-up menu, except that you have the option to select separate AUTO-WORK values for **Seastate** filter, **Rudder**, **Counter Rudder** and **RateOfTurn/Radius**. Move through the menu item by pressing the Port and Stbd buttons. Use the course knob to change value.

These values are stored in the AP50 memory and are automatically recalled when returning to AUTO-WORK mode.

Aw	SETUP
	Move :
	Adjust :
	Trim
	Speed Log
341°	P01°
CTS	00.0kt
340.7	Turn mode
Gyro1	W RateOfTurn
	ROT
	240°/min
	Thruster sens
	01°
	← More →

Use the course knob to adjust the trim value, if needed. The manual trim setting compensates for the **Autotrim**, which takes time to execute the appropriate rudder offset.

Note that the **Trim** setting is not stored.

The Off Heading Limit setting is not available in Auto-Work mode.

Note !

*The values for **Rudder** and **Counter Rudder** will have an effect on the vessel's steering characteristics independent of which steering function is selected (rudder, thruster, or rudder and thruster).*

NAV Mode

The NAV mode will not work satisfactorily before AUTO mode is set-up and working properly.

Backlight

Same procedure as in STANDBY mode.

Contrast

Same procedure as in STANDBY mode.

Steering Function

Same procedure as in STANDBY mode.

Seastate Filter

Same procedure as in AUTO mode.

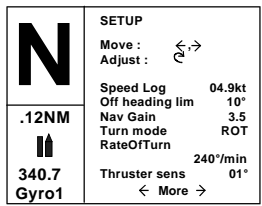
Rudder

Same procedure as in AUTO mode.

Counter Rudder

Same procedure as in AUTO mode.

N	SETUP
	Move :
	Adjust :
	Backlight
	Contrast
.12NM	Steering function
	Rudder
340.7	Seastate
Gyro1	Rudder
	Count Rudder
	← More →



Speed Log

Same procedure as in STANDBY mode.

Off Heading Lim

Same procedure as in AUTO mode.

Nav Gain

The Navigation Gain determines how many degrees the autopilot must change the vessel’s heading in order to bring the vessel back on track using the Cross Track Error and the vessel’s speed.

The higher the value of the **Nav Gain**, the greater the correction.

If the value is set too low, the vessel may use a long time to reach the track. It can also drift away at strong side current.

Too high value will cause the vessel to overshoot or oscillate around the track.

The default setting depends on the boat length and the range is 0.5 to 7.0.

Turn Mode

Same procedure as in AUTO mode.

ROT/RAD

Same procedure as in AUTO mode.

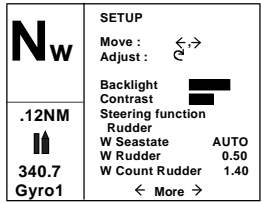
Thruster Sens

Same procedure as in AUTO mode.

NAV-WORK Mode



To enter the User Set-up menu when in NAV-WORK mode, quickly double press the NAV-button.



The User Set-up menu for the NAV-WORK mode is identical to the NAV mode User Set-up menu, except that you have the option to select separate NAV-WORK values for **Seastate** filter, **Rudder**, **Counter Rudder** and **RateOfTurn**. Move through the menu item by pressing the Port and Stbd buttons. Use the course knob to change value.

Selected values for **Seastate** filter, **Rudder**, and **Counter Rudder** are stored in the AP50 memory and are automatically recalled when returning to NAV-WORK mode.

Nw	SETUP
	Move : ↵→
.12NM	Adjust : ↵→
	Trim P01°
340.7	Speed Log 04.9kt
	Nav Gain 3.5
Gyro1	Turn mode ROT
	W RateOfTurn 240°/min
	Thruster sens 01°
	← More →

Use the course knob to adjust the trim value, if needed. The manual trim setting compensates for the **Autotrim**, which takes time to execute the appropriate rudder offset.


Note that the trim setting is not stored.

The Off Heading Limit setting is not available in Auto-Work mode.

Note !

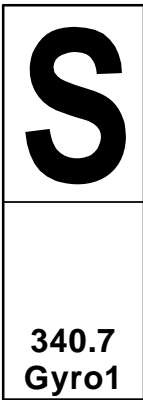

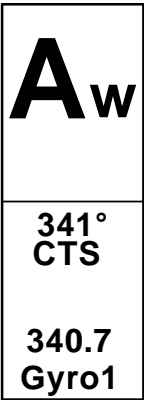
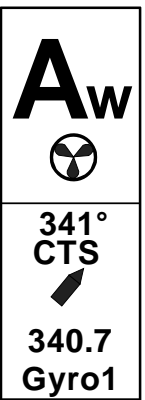

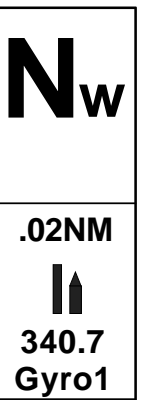
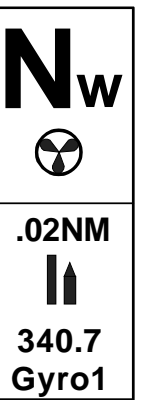
*The values for **Rudder** and **Counter Rudder** will have an effect on the vessel's steering characteristics independent of which steering function is selected (rudder, thruster, or rudder and thruster).*


2.15 Instrument Screens and Menu

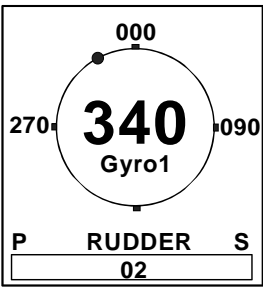
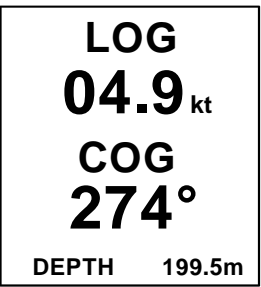
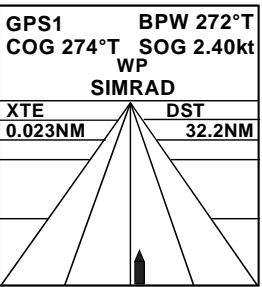
A number of instrument screens are available under each mode screen if the required NMEA 0183 sentences are provided (Refer to the Installation Manual, NMEA Sentences). Activate the instrument screen by pressing the  (INFO) button.

Note ! *The Instrument screens are also available on locked units.*

The left-hand side of the display will show the following information, depending on the mode:

						
STANDBY. Heading. Heading input source.	AUTO	AUTO-WORK	AUTO-WORK w/thruster	NAV	NAV-WORK	NAV-WORK w/thruster
		Set course			Cross Track error	
	Heading/Heading input source.			Heading/Heading input source.		

Move through the available instrument screens by repeatedly pressing the  (INFO) button. The right-hand side of the display will show the following instrument screens:

		
Main	Speed/Course/Depth* (Speed from LOG, SOG or MAN)	Motorway

* The depth reading is referenced to the transducer, not the keel.

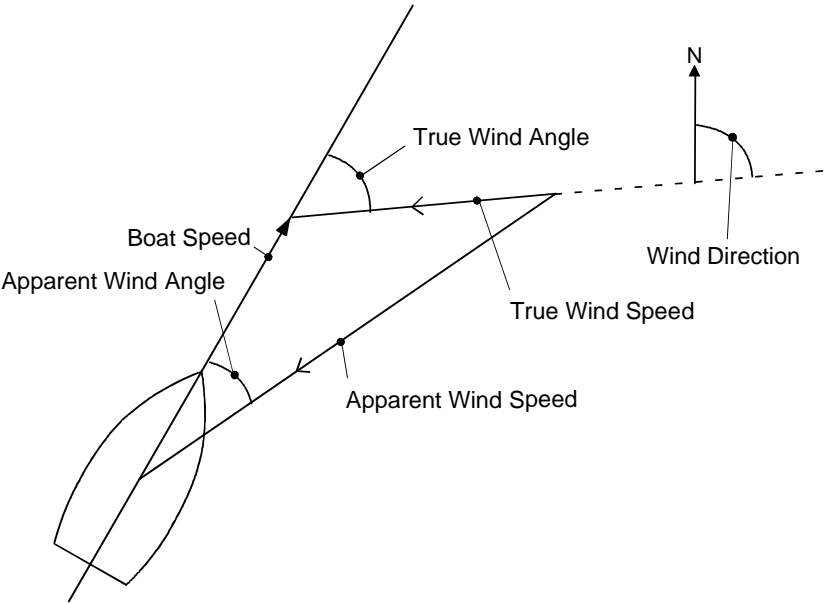
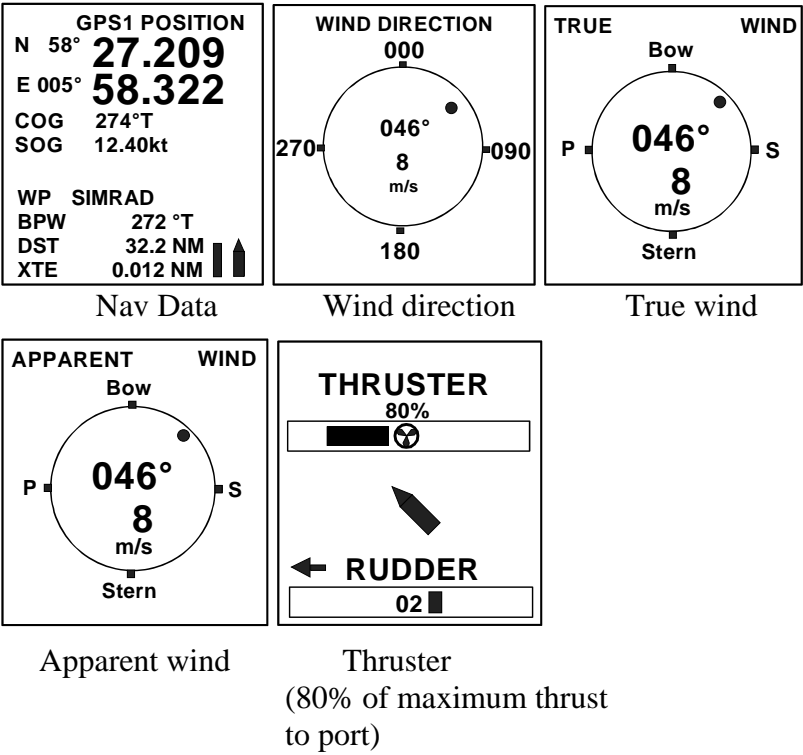



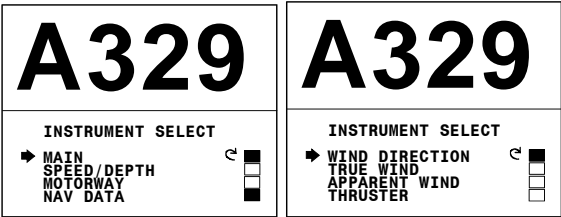



Figure 2-2 Definition of Apparent Wind/ True Wind, and Wind Direction

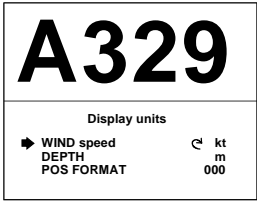
Screen Selection


If you do not need all of the instrument screens to be present in the screen menu, you may temporarily remove screens by quickly double-pressing the  (INFO) button. Move through the screens by pressing the  (PORT) and  (STBD) buttons. Each screen can be removed or selected by rotating the course knob.



Return to last instrument screen by a simple press on the  (INFO) button.

Instrument Set-up.



This screen gives access to the display unit set-up of the wind speed, depth, and position format. Press and hold the  (INFO) button to activate the screen.

Use the Stbd button to select an item and the course knob to select the unit.

Note ! *The depth reading is referenced to the transducer, not the keel.*

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3 MAINTENANCE

3.1 Control unit

Under normal use, the AP50 Control Unit will require little maintenance. The case is made from seawater resistant aluminum and it has a polyester coating to withstand the rigorous conditions of an exposed cockpit. It is recommended that units kept clean of salt, since salt will corrode metal over time.

If the unit requires any form of cleaning, use fresh water and a mild soap solution (not a detergent). It is important to avoid using chemical cleaners and hydrocarbons such as diesel, petrol etc.

Make sure that all open Robnet connectors are fitted with a protection cap at all times.

It is advisable at the start of each season to check all connections to the control unit head and to cover them with Vaseline or WD40 as needed.

3.2 Junction Unit

No special maintenance is required. However, it is advisable, to make a yearly check of all connections and visually inspect the inside of the unit.

3.3 Rudder Feedback

Make a visual inspection at 2 to 3 month intervals and at the start of each season. Apply grease to the ball joints when required.

3.4 Compass (RC25)

If the compass is exposed to outdoor conditions, make a visual inspection at 2 to 3 months intervals and at the start of each season.

3.5 Drive unit

Refer to the drive unit manual for maintenance instructions.

3.6 Exchange of software program

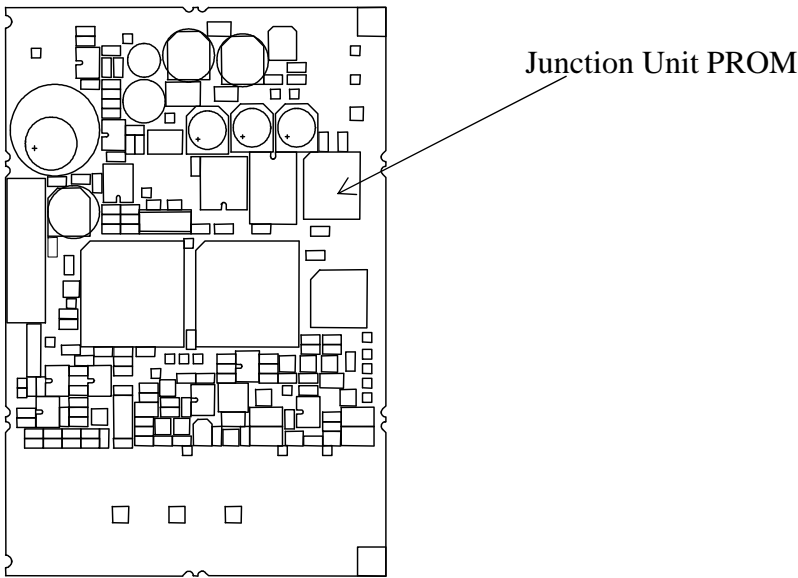


Figure 3-1 J50/J50-40 Main PCB, Component Layout

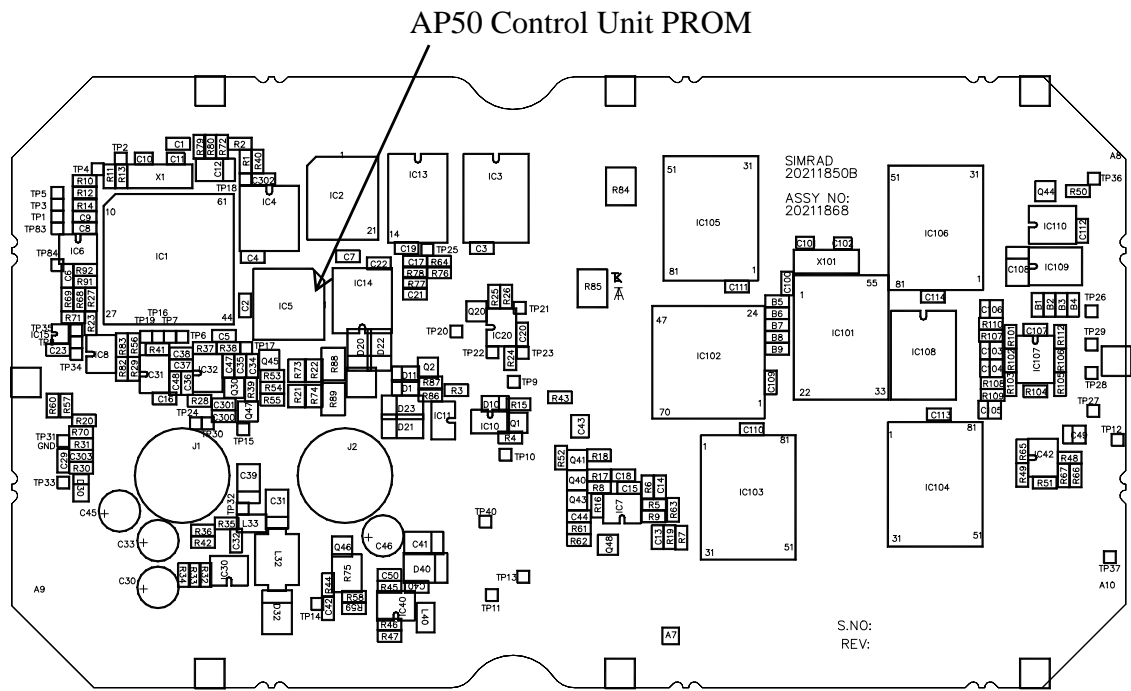
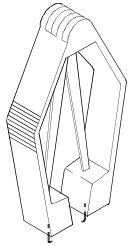
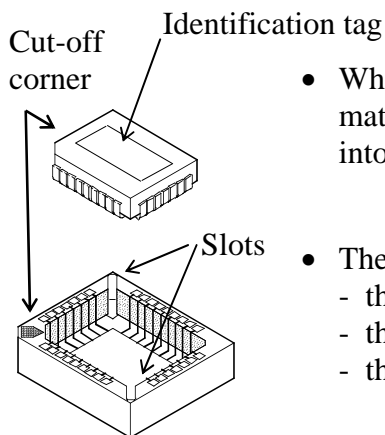


Figure 3-2 AP50 PCB, Component Layout



PROM extraction
tool

- Remove the Programmable Read-Only Memory (PROM) from the socket with the PROM extraction tool (part number 44139806).
- Insert the tool by pressing the two grip pins down into the two slots in the corners of the socket.
- Squeeze the tool and pull out the PROM.



- When inserting new PROMS, make sure its cut-off corner matches with the corner in the socket. Press the PROM gently into the socket.
- The identification tag on the PROM indicates:
 - the name of the unit
 - the Simrad part number
 - the software version

Caution !

Make sure that the correct PROM is mounted in each unit:

PROM for the AP50 Control Unit: P/N 20212189

PROM for the J50 and J50-40

Junction units: P/N 20211934

- After changing a PROM, perform a master reset (Refer to *Installation Menu/Service/Master reset*).

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4 TROUBLESHOOTING

An autopilot is a complex system. Its performance depends on a proper installation and a successful sea trial.

In the event of an autopilot failure, the AP50's numerous test features will assist you in isolating a probable fault.

Audible and visual alarm is provided for every fault being detected.

The audible alarm is reset by pressing any button (e.g. by changing mode from AUTO to STANDBY). All visual alarms will remain and alternate with the operating display until the fault has been rectified. If an external alarm buzzer is installed (Refer to the Installation Manual, External Alarm) the external alarm will be given 5 sec. after the internal. Refer to the table below for hints if you would like to try and solve the problem yourself. However, most of the problems may require the assistance of a Simrad dealer.

Perform any repair actions in the listed sequence.

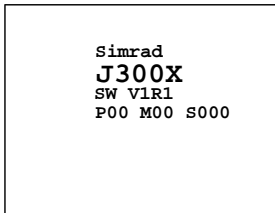
Note !

For AP50 Plus system, the J50 boards are located inside the JD5X Distribution unit.

Note !

'Compass difference', 'Vessel off course', and 'Rudder limit' warnings are automatically reset when the error is rectified.

4.1 Warnings

Display readout	Probable fault	Recommended action
	If the J300X/J3000X status display is shown at switch on, the start-up sequence will stop to indicate that an invalid junction unit is installed	Install the J50 Junction Unit or JD5X Distribution Unit.
System failure alarms:		
Rudder feedback failure (autopilot operates on simulated feedback and the simulated feedback angle is shown in the display)	Rudder feedback signal is missing or erratic. Analog rudder not installed. <i>For AP50 Plus system also refer to trouble shooting section in the installation manual.</i>	<ol style="list-style-type: none"> 1. Check all connections. 2. Check the alignment as per the installation instructions. 3. Replace rudder feedback unit. 4. Install analog rudder.
Flashing rudder angle indicator	Rudder not selected under the Steering function.	Select Rudder under Steering function in the User Set-up menu.

Display readout	Probable fault	Recommended action
No rudder response (The system will switch to Stby mode)	<ul style="list-style-type: none"> Steering gear not operative Broken connection Missing power Rudder feedback not moving with rudder <p><i>Note!</i></p> <p><i>It is recommended to try to locate the fault to either the <u>rudder drive</u> (command signal, steering gear, pump, bypass valve, clutch etc.) or the <u>rudder feedback</u> by giving NFU/FU commands on the control unit and observing the rudder response on the feedback readout of the same unit.</i></p> <ul style="list-style-type: none"> Defective electronics 	<p><i>Note!</i></p> <p><i>If rudder control is from an AD50 or a JD5X, refer to the troubleshooting section in the AD50 manual or the AP50 Plus Installation Manual.</i></p> <ol style="list-style-type: none"> Check all connections. Check Rudder FB transmission link, steering gear, and change over switches. Check the drive unit motor/brushes and bypass valve/clutch. <p>For solenoid drive:</p> <ol style="list-style-type: none"> Check LEDs for command from galvanic isolated solenoid electronics (Refer to the AP50 Installation Manual, Junction Unit terminals). Replace the junction unit Power PCB. Check the jumper switch (S1) setting on J50 Power PCB.
Rudder too slow	Excessive load on steering gear, air in the hydraulic system or insufficient drive unit capacity.	<ol style="list-style-type: none"> Look for mechanical obstructions at the rudder/tiller/quadrant. Check the back drive force. Bleed the hydraulic system. Replace with a bigger pump unit.
Rudder test failed	The following conditions may exist: a) Rudder feedback failure. b) J50 current overload. c) Bypass/clutch overload.	Refer to the recommended actions for the specific probable faults.
	Rudder moves in only one direction a) Poor connection to one of the solenoids (continuously running pump). b) Faulty Power PCB in junction unit.	<ol style="list-style-type: none"> Check the connections Replace the junction unit Power PCB

Display readout	Probable fault	Recommended action
Rudder test failed (continued)	Rudder test not completed within 2 min. a) Poor connections to the drive unit. b) Faulty Main PCB in the junction unit. c) Faulty Power PCB in junction unit.	a) Check the connections. b) Replace the Main PCB c) Check the Power PCB for traces of burned transistors. – Change Power PCB.
	Rudder moves at full speed to one side. a) Faulty Power PCB in junction unit.	Replace the junction unit Power PCB
Rudder limit	The set rudder limit has been reached or exceeded.	This is a warning only and may be caused by disturbance to compass (waves), speed log, sharp turn or improper parameter setting.
Steering compass missing Monitor compass missing	No data from the selected compass.	1. If more than one compass is connected to the system, refer to the User Set-up menu to select a different compass. 2. Check the connections and the Interface menu for proper set-up. 3. Service appropriate compass.
Failure active Control Unit	Active control unit goes silent.	1. Press the STBY button on an "Inactive" unit to reset. 2. Check/repair the Robnet cable. 3. Replace the control unit PCB.
J50 current overload (Remains in actual mode without any rudder command)	The drive unit shut down due to an excessive load or a short circuit.	1. Check the drive unit and drive unit installation. 2. Disconnect the drive unit. If the fault is still present, replace the junction unit Power PCB.
J50 Internal Voltage	Internal 15 V supply in junction unit is below the limit.	1. Replace the junction unit Main PCB. 2. Replace the junction unit Power PCB if Mains voltage is 12V.
J50 high temp.	Excessive temperature in the junction unit (>75°C), possible long term overload.	1. Switch off the autopilot. 2. Check for backload in the drive unit/steering system. 3. Check that the junction unit specifications match those of the drive unit.

Display readout	Probable fault	Recommended action
Bypass/clutch overload	Clutch/bypass current exceeds specified load (overload or short circuit)	<ol style="list-style-type: none"> 1. Check actual current 2. Check voltage marking on coil 3. Check coil resistance (through connecting wires)
Memory failure	Wrong checksum on memory parameters or variables in the J50 Junction Unit or GI51 Gyro Interface.	<p>Switch off and on again. If the alarm is repeated and a GI51 is installed, switch off – disconnect GI51 – switch on again. If the alarm is repeated, the fault has been located to J50, otherwise GI51 has caused the fault.</p> <p>If installed, reconnect GI51, perform a "Master reset" and make a new "Dockside" and "Interface" set-up. Switch off and on again. If the alarm is repeated, replace Junction unit Main PCB or GI51.</p>
Com. failure with J50	Faulty junction unit or poor Robnet cable connections from the junction unit.	<ol style="list-style-type: none"> 1. Check the Robnet connectors and cable. 2. Replace the junction unit Main PCB.
Low supply voltage	Mains voltage less than 9 V.	<ol style="list-style-type: none"> 1. Verify in the System Data menu 2. Switch autopilot off and charge batteries. 3. Check/repair battery charger.
High supply voltage	J50, J50-40 Mains exceeds 44 V.	<ol style="list-style-type: none"> 1. Verify in the System Data menu 2. Switch the autopilot off. 3. Check/repair battery charger.
Compass difference	The difference in readings between the main compass and the monitor compass exceeds the limit set for "Compass difference".	Check the operation of both compasses (Refer to the Installation Manual, System Data). If one compass is magnetic, the error may be caused by deviation change or heavy sea disturbances (Refer to the Installation Manual, Compass Difference).
Speed missing (Automatic reset when available, see page 31)	The speed signal from the GPS or the log is missing (15 sec. delay).	Check the GPS, log, and cable connections.

Display readout	Probable fault	Recommended action
No rudder cntrl voltage	Ref. voltage for analog rudder control is missing.	For AP50 Plus system, refer to the troubleshooting section in the AP50 Plus Installation Manual.
No thruster valve voltage	<ol style="list-style-type: none"> 1. External reference voltage missing for analog thruster control. 2. Internal voltage missing for $\pm 10V$ or 4-20mA thruster control. 	<p>Check voltage on TI51 - TB4.</p> <p>Wrong setting of S1, S2 in TI51. Check internal $\pm 12V$ (+12V between S1-left and TB5-3) (-12V between S2-left and TB5-3).</p>
No thruster response	<ol style="list-style-type: none"> 1. Speed too high for thruster operation 2. J50 has lost communication with the TI51 Thruster Interface. 3. Broken connection or defective electronics. 	<ol style="list-style-type: none"> 1. Refer to set limit for Thruster Inhibit. See "Thruster Inhibit" in the AP50 Installation Manual. 2. Check cabling or operation of the TI51 Thruster Interface. Refer to separate TI51 Manual. 3. Try to switch system off and on 4. Check thruster installation. 5. Replace unit.
Vessel off course	Extreme weather conditions, very slow speed, or boats heading is outside the fixed Off heading limit of 20° (automatic reset when inside the limit).	<ol style="list-style-type: none"> 1. Check the steering parameters (Rudder, Autotrim, Seastate filter). 2. Increase the Rudder value 3. Increase the boat speed, if possible, or steer manually. 4. Check the steering gear and autopilot interface.
End of route	Warning given on the active control head when the "END ROUTE" waypoint name has been received from the navigator/ECS.	
NAV. data failure (---). Refer to the "Service Menu" in AP50 Installation Manual.	Missing or invalid Nav. data.	<ol style="list-style-type: none"> 1. Use NMEA Test menu. 2. Check the Nav. receiver set-up.

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5 GLOSSARY

Apparent wind – The speed and direction from which the wind appears to blow with reference to the bow when the boat is moving (also called relative wind).

Arrival alarm – An alarm signal issued by a voyage-tracking unit that indicates arrival at or at a predetermined distance from a waypoint. (see arrival circle).

Arrival circle – An artificial boundary placed around the destination waypoint of the present navigation leg, the entering of which will signal an arrival alarm.

Arrival perpendicular – Crossing of the line which is perpendicular to the course line and which passes through the destination waypoint.

Bearing – The horizontal direction of one terrestrial point from another, expressed as the angular distance from a reference direction, usually measured from 000° at the reference direction clockwise through 359°.

BPW – Bearing position to waypoint – Bearing to a specified waypoint from present position.

BWW – Bearing waypoint to waypoint - Bearing angle of the line between the “TO” and the “FROM” waypoint, calculated at the “FROM” waypoint for any two arbitrary waypoints.

COG - Course Over Ground - The actual direction of progress of a vessel with respect to the surface of the earth. The vessels heading may differ from the course over ground due to the effects of wind, tide, currents.

ECS – Electronic Chart System

For advanced navigation steering with preset radius in routes of waypoints.

ECDIS – Electronic Chart Display Information System.

Type approved ECS system according to the ECDIS regulations.

GPS - Global Positioning System - This system consists of 18 satellites plus 3 spares in fixed orbits, circling the earth at an altitude of approximately 20,200 km. The system will provide the user with 24 hour a day all weather position coverage, with an accuracy of 15 to 100 meters.

Great circle route – A course that is the shortest distance between two points, following a great circle

Heading – The horizontal direction in which a ship actually points or heads at any instant, expressed in angular units from a reference direction, usually from 000° at the reference direction clockwise through 359°.

IMO MSC(64)67 – (International Maritime Organization) Performance standards for heading control system.

ISO 11674:2000(E) – (International Organization for Standardization) Specifies the structure, performance, inspection and testing of heading control systems.

Loran C - A complex radio navigation network developed by the US coast guard, to assist a navigator in determining his precise location. The acronym, Loran C, stands for Long Range Navigation. It is an all weather 24 hour a day electronic system of shore based radio transmitters.

Magnetic bearing – Bearing relative to magnetic north; compass bearing corrected for deviation.

Magnetic deviation – Compass error; the difference between the reading of a compass and the actual magnetic course or bearing due to errors in the compass reading.

Magnetic heading – heading relative to magnetic north.

Magnetic variation - A magnetic compass points to the magnetic north pole. The difference between this direction and true north is the magnetic variation. The amount and direction of this variation is dependent upon where on the earth you are located.

NMEA 0183 - A format (language) designed to permit communication between various types of marine electronic equipment. In essence, this is a two-wire shielded, serial data link, permitting one device to talk while other devices listen. Numerous different sentences are available, permitting communication between various different devices.

Rhumb line – A line that passes through all meridians at the same angle. When drawn on a Mercator chart, the rhumb line is a straight line. However, the Mercator chart is a distortion of a round globe on a flat surface, so the rhumb line will be a longer course than a great circle route.

Route - A stored sequence of waypoints. These waypoints will be listed in the order in which you desire to follow them.

SOG - Speed over ground is the actual speed of the vessel relative to the ocean floor.

True bearing – Bearing relative to true north; compass bearing corrected for compass error.

True heading – Heading relative to true north (the meridian).

VDR – Voyage Data Recorder. Recording and storing all information that can be relevant for reconstructing accidents, such as time, date, position, speed, heading, depth, video, communication, etc. Performance requirements are specified in the IMO A.861(20), the EU directive 1999/35/EC and IEC61996.

Waypoint - A discrete point, stored in a navigator, located on the surface of the earth. Normally this point will be identified by Lat/Lon coordinates although in some systems it may be shown by T.D.'s.

XTE - Cross Track Error - Used to identify a vessels position relative to a straight line drawn between two waypoints. The amount the vessel is off to the left or to the right of this line is known as the track.

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